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STATE OF VERMONT
PUBLIC SERVICE BOARD

Investigation re: Establishment of a Standard-)
Offer Program for Qualifying Sustainably)
Priced Energy Enterprise Development) Docket No. 7533
("SPEED") Resources)

PREFILED TESTIMONY OF
JASON S. GIFFORD
ON BEHALF OF
GREEN MOUNTAIN POWER CORPORATION

November 3, 2009

The purpose of Mr. Gifford’s prefiled testimony is to provide information to support the establishment of long-term standard contract prices for solar PV generation projects.

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PUBLIC SERVICE BOARD**

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**PREFILED TESTIMONY OF JASON S. GIFFORD
ON BEHALF OF GREEN MOUNTAIN POWER CORPORATION**

November 3, 2009

Q1 Please state your name, occupation and business address.

A1 My name is Jason Gifford. I am a Consultant at Sustainable Energy Advantage, LLC
("SEA"). SEA is a service and consulting practice, which provides technical support to
private sector, public sector, and non-profit organizations in developing opportunities
for clean, renewable sources of energy in competitive wholesale and retail electricity
markets. My business address is 10 Speen Street, Framingham, Massachusetts, 01701.
A summary of my professional qualifications and experience will be provided upon
request.

Q2 Have you ever testified before the Public Service Board?

A2 No.

1 **Q3 What is the purpose of your testimony?**

2 A3 SEA has been retained by Green Mountain Power Corp. ("GMP"), to provide analysis and
3 testimony with respect to recent trends in the installed cost of U.S. solar projects. The
4 purpose of my testimony is to:

5 (1) Present and explain data on the actual historic cost to install over 31,000 solar PV
6 systems from California to Massachusetts from 2006 to 2009;

7 (2) Demonstrate that the installed cost of PV systems was relatively constant from 2006
8 through 2008, and has decreased in the first nine months of 2009;

9 (3) Provide data demonstrating that economies of scale exist in the development of
10 solar PV projects;

11 (4) Suggest that the overwhelming number of solar applications entering the queue on
12 the program's first day certifies that the current \$0.30/kWh rate incentivized more
13 than just the most cost-effective projects;

14

15 **Q4 Have any nation-wide studies been completed regarding the actual historic cost of**
16 **recently installed solar PV projects?**

17 A4 Yes. The Lawrence Berkeley National Laboratory, a nationally-recognized thought-
18 leader in renewable energy policy and researcher of renewable energy markets,
19 announced the release of "**Tracking the Sun II: The Installed Cost of Photovoltaics in the**
20 U.S. from 1998 – 2008" on October 21, 2009. The report is available at:

21 <http://eetd.lbl.gov/ea/emp/re-pubs.html>.

Q5 What does the LBNL Report conclude about the recent installed cost of solar PV?

A5 The Report concludes that the cost of solar installations, which had remained flat in recent history, declined an average of \$0.30/Watt for systems completed in 2008.

According to the Report, PV module costs dropped by approximately \$0.50/Watt from 2007 to 2008.

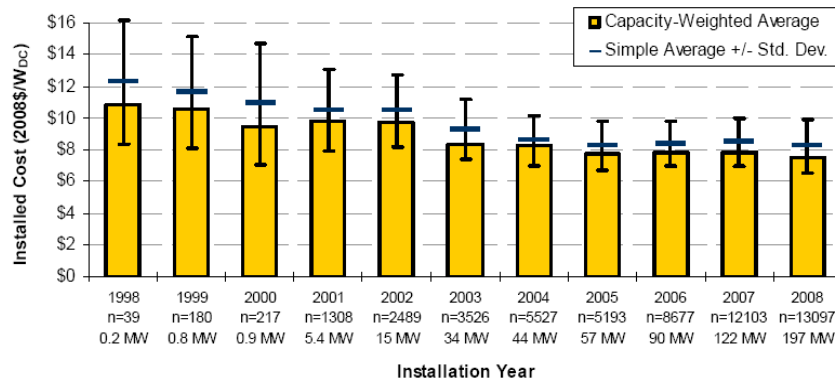


Figure 1 - U.S. Solar Installation Costs, by Year

Q6 Did you collect and analyze any state-specific solar PV cost data? Do these data support the conclusions of the LBNL Report? What trends do these data demonstrate regarding PV pricing in 2009? Please quantify any decreases in solar PV installed costs.

A6 Yes, we gathered data from over 31,000 solar PV projects awarded in California between 2006 and 2009, as well as data from more than 1,000 PV projects awarded in Massachusetts during the same period. In order to better understand and interpret

these data, we grouped and filtered these PV systems in several different ways to determine the impact of project size on installed cost, and the variation in cost throughout the 2006 to 2009 time period.

These data corroborate the conclusions of the LBNL Report with respect to historic installed cost data, and demonstrate significant cost reductions for the PV market in 2009. In the California market, which accounts for nearly 81% of all of the systems in the United States, installed cost trends have closely followed with the Report's findings. As Figure 2 indicates, prices remained fairly steady from 2006 to 2008. Significant cost decreases, as much as \$1,500/kW, have already been realized in 2009, particularly for systems greater than 100/kW.

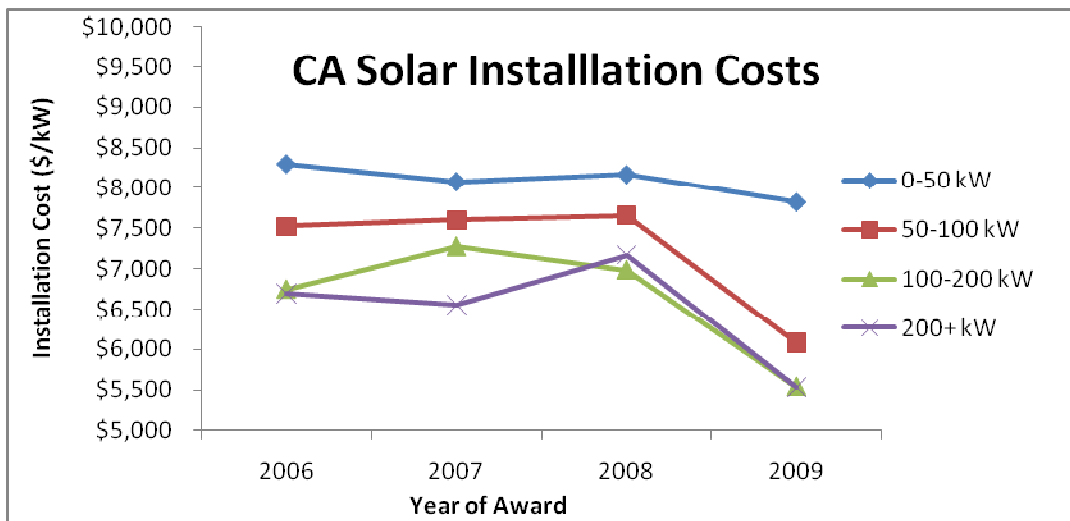


Figure 2 - California Solar Installation Costs, by Year

We subsequently analyzed data from the Massachusetts' solar programs, using the same methodology and capacity-based bin groupings. The data indicate that Massachusetts' experience installing photovoltaics to date also supports the LBNL long

term trend analysis. These results are depicted in Figure 3 below¹. Massachusetts has already realized cost decreases as high as \$700/kW between 2008 and 2009.

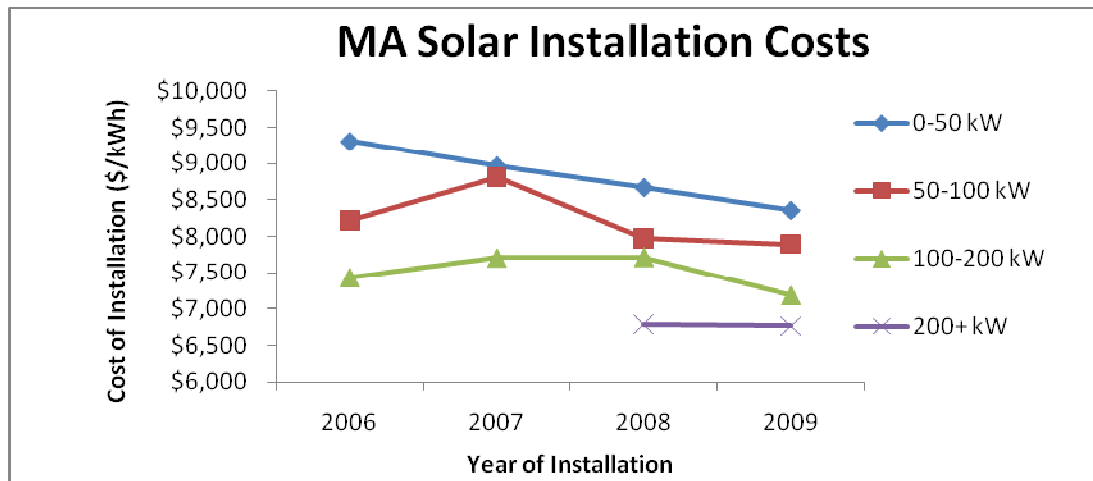
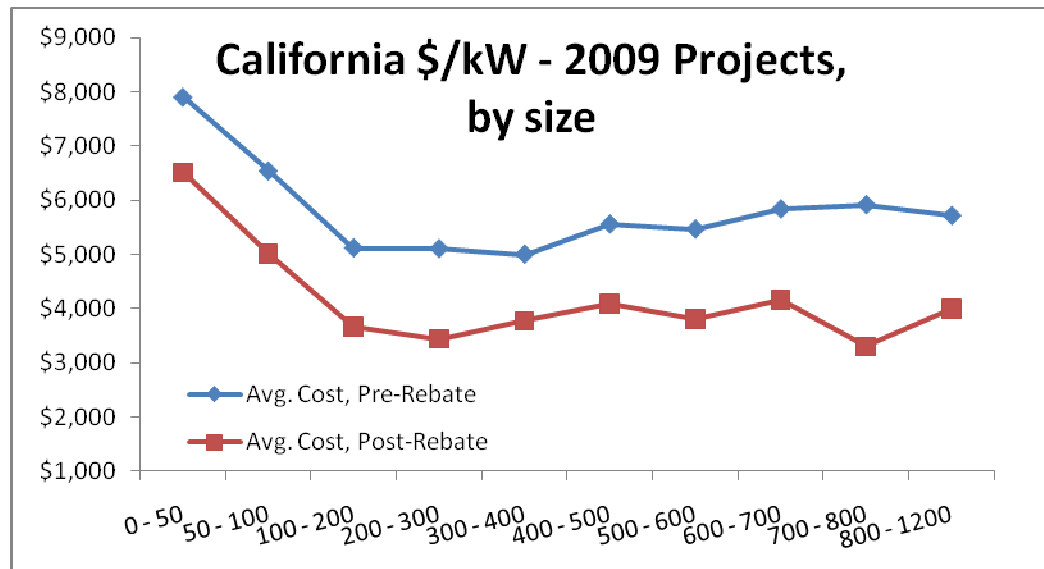


Figure 3 - Massachusetts Solar Installation Costs, by Year

Next, we returned to the California data, with a more detailed focus on the over 6,500 projects recorded from January 1st through the beginning of October, 2009. By separating out the most recent projects, we hoped to improve our understanding of solar cost trends. Figure 4 shows the installed costs realized in 2009 to date, and demonstrates the economies of scale associated with commercial and utility-scale

¹ You will note that Figure 3 does not contain data for 2006 and 2007 in the 200+ kW bin. The Massachusetts Renewable Energy Trust – which tracks the data included in this testimony – participated in only one solar project in each of these years. We are including the cost data associated with these two projects as a footnote, but do not believe that a sample size of one project justifies including in Table 3. The 2006 project was a 460 kW project with an installed cost of \$7,211/kW. The 2007 project was a federally-funded project designed to demonstrate a scaled application of an emerging technology. As such, the 378 kW project's installed cost of \$13,299/kW is not representative of other similarly-sized projects.

1 projects – which averages just under \$5/Watt for the 300 kW to 400 kW bin, before
2 taking state incentives into account.
3



4
5 **Figure 4 – 2009 California Solar Installation Costs, by size**

6 In Massachusetts, where month by month award data is readily available, the steady
7 decrease in overall system pricing is apparent. Between May, 2009 and September,
8 2009, the average price has decreased by more than \$1,300/kW.

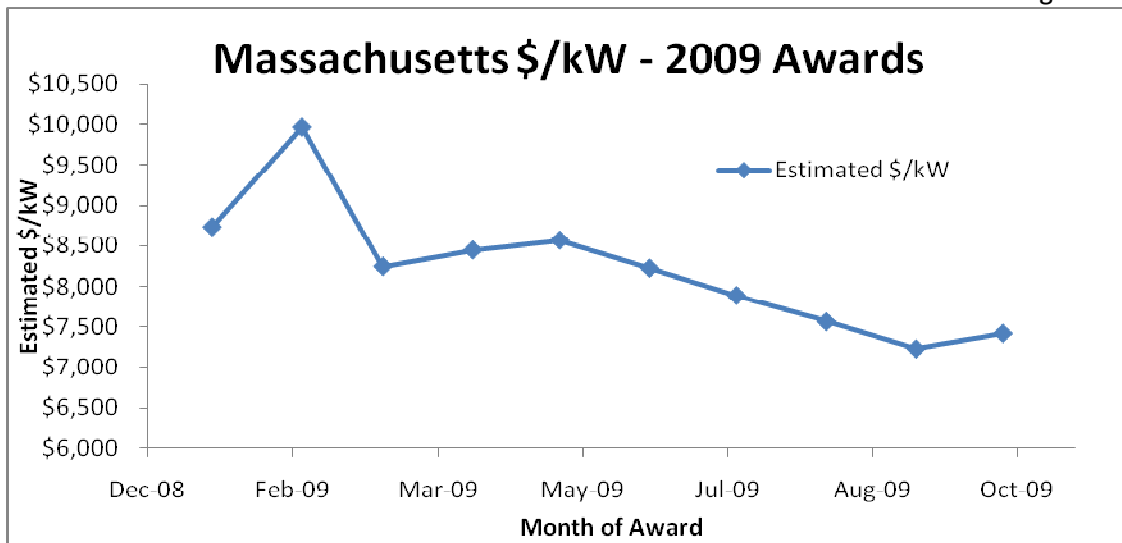


Figure 4 - Massachusetts Solar Installation Costs, by Month

As evidenced by the Massachusetts and California market summary data, solar costs are declining in 2009. Numerous articles have recently been published highlighting these declines in solar pricing in 2009 (see “More Sun for Less: Solar Panels Drop in Price”, New York Times, August 26, 2009, and “Module Pricing: Rational, or Just Plain Nuts?” Photovoltaics World Magazine, September 16, 2009). A report titled “Global Trends in Sustainable Energy Investment 2009,” published by the United Nations Environment Program and New Energy Finance in June 2009, states that “The price of solar PV modules...is predicted to fall by over 43% in 2009.” The data available at the time this testimony was drafted clearly show the beginning of this downward cost trend. It is difficult to predict the magnitude of solar installed cost reductions for the remainder of 2009 and 2010.

Q8 Based on your review and analysis of existing solar projects, can you please provide a set of assumptions for use in modeling the expected levelized cost of energy from a 500 kW solar PV project constructed under current market conditions?

A8 Yes. The following assumptions are provided:

Summary of Solar Modeling Assumptions²			
Inflation	2.5%	Net Capacity Factor	13.5%
Debt Svc Reserve	4.5 months	Project Size	500 kW
WC/O&M Reserve	6 months	Total Project Cost*	\$5,000/kW
Project Life	25 Years	Inverter Replacement (Yr 12)	\$270/kW
Debt Tenor	20 Years	O&M	\$6/kW
Debt/Total Capital	35%	Property Tax	1% of total cost**
Cost of Debt	7%	Insurance	\$25K/MW/Yr
* Includes cost of financing and initial funding of reserve accounts.			
** Decreasing annually subject to same assumptions as previous model runs.			

One minor structural change was made to the model. This model run assumes a 0.5% annual degradation in the project's kWh output.

Q9 What conclusions can be drawn about the interim solar tariff rate based on the volume of applications submitted on the first day of the Standard Offer program?

A9 The SPEED Administrator received applications from 185 solar projects requesting Standard Offer contracts at the interim rate of \$0.30/kWh. On its face, the application

² Assumptions are presented in this table in the order in which they appear in the model.

1 of over 161 MW for 12.5 MW of available contracts strongly suggests that \$0.30/kWh
2 incentivizes far more than the most cost-effective Vermont solar projects. Through a
3 lottery, 16 projects were selected. They range in size from 2 kW to 2,200 kW (the
4 single-project cap). Based on the four years of installed cost data presented in this
5 testimony, the actual cost of energy from these facilities will vary significantly. The cost
6 per kWh from the MW-scale projects will be substantially less than the cost of projects
7 measured in the tens of kW. Based on the receipt of proposals from 74 projects with a
8 capacity equal to or greater than 1 MW, one can reasonably conclude that the interim
9 rate could have been set to reflect an estimate of the most efficient Vermont solar
10 projects and still have easily met the program goals. These 74 utility-scale applications
11 totaled over 138 MW, and applications from 2.2 MW projects alone totaled 92.4 MW.
12 In other words, applications from projects demonstrated by California and
13 Massachusetts data to be the most cost-effective provided enough MW to meet the
14 Standard Offer program's total installed capacity goals almost twice over – and enough
15 to meet the technology-specific maximum 25% allocation almost four times over. The
16 conclusion that should be drawn from these facts is that future Standard Offer rates
17 should be set at levels that enable economies of scale to inure to the benefit of Vermont
18 ratepayers. In this fashion the State can fulfill the remainder of its SPEED goals at the
19 least total dollar cost to ratepayers.

1

2 Q10 **Does this conclude your pre-filed testimony?**

3

4 A10 Yes.